06-16-00

A

Please type a plus sign (+) inside this box → [+]

PTO/SB/05 (4/98)
Approved for use through 09/30/2000. OMB 0651-0032
Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 C.F.R. § 1.53(b))

Attorney Docket No.	E0902
First Inventor or Application Identifier	Oikwan Tsang
Title	PROGRAMMABLE BI-DIRECTIONAL MII TESTING ...
Express Mail Label No.	EJ887877334US

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

ADDRESS TO: Assistant Commissioner for Patents, Box Patent Application, Washington, DC 20231

1. [✓] * Fee Transmittal Form *(e.g., PTO/SB/17)* *(Submit an original and a duplicate for fee processing)*
2. [✓] Specification [Total Pages 14] *(preferred arrangement set forth below)*
   - Descriptive title of the Invention
   - Cross References to Related Applications
   - Statement Regarding Fed sponsored R & D
   - Reference to Microfiche Appendix
   - Background of the Invention
   - Brief Summary of the Invention
   - Brief Description of the Drawings *(if filed)*
   - Detailed Description
   - Claim(s)
   - Abstract of the Disclosure
3. [✓] Drawing(s) *(35 U.S.C. 113)* [Total Sheets 5]
4. Oath or Declaration [Total Pages 2]
   a. [✓] Newly executed (original or copy)
   b. [ ] Copy from a prior application (37 C.F.R. § 1.63(d)) *(for continuation/divisional with Box 16 completed)*
      i. [ ] DELETION OF INVENTOR(S) Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. §§ 1.63(d)(2) and 1.33(b).

NOTE FOR ITEMS 1 & 13: IN ORDER TO BE ENTITLED TO PAY SMALL ENTITY FEES, A SMALL ENTITY STATEMENT IS REQUIRED (37 C.F.R. § 1.27), EXCEPT IF ONE FILED IN A PRIOR APPLICATION IS RELIED UPON (37 C.F.R. § 1.28).

5. [ ] Microfiche Computer Program *(Appendix)*
6. Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all necessary)*
   a. [ ] Computer Readable Copy
   b. [ ] Paper Copy (identical to computer copy)
   c. [ ] Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

7. [✓] Assignment Papers (cover sheet & document(s))
8. [ ] 37 C.F.R.§3.73(b) Statement *(when there is an assignee)* [ ] Power of Attorney
9. [ ] English Translation Document *(if applicable)*
10. [ ] Information Disclosure Statement (IDS)/PTO-1449 [ ] Copies of IDS Citations
11. [ ] Preliminary Amendment
12. [✓] Return Receipt Postcard (MPEP 503) *(Should be specifically itemized)*
13. [ ] * Small Entity Statement(s) *(PTO/SB/09-12)* [ ] Statement filed in prior application, Status still proper and desired
14. [ ] Certified Copy of Priority Document(s) *(if foreign priority is claimed)*
15. [✓] Other: Certificate of Mailing

16. **If a CONTINUING APPLICATION,** *check appropriate box, and supply the requisite information below and in a preliminary amendment:*

[ ] Continuation [ ] Divisional [ ] Continuation-in-part (CIP) of prior application No: _____/_____

Prior application information: Examiner _____ *Group / Art Unit:* _____

For CONTINUATION or DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 4b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

17. CORRESPONDENCE ADDRESS

[ ] *Customer Number or Bar Code Label* *(Insert Customer No. or Attach bar code label here)* or [✓] *Correspondence address below*

Name	Jonathan A. Platt				
	RENNER, OTTO, BOISSELLE & SKLAR, LLP				
Address	1621 Euclid Avenue				
	19th Floor				
City	Cleveland	State	OH	Zip Code	44115
Country		Telephone	216-621-1113	Fax	216-621-6165

Name (Print/Type)	Jonathan A. Platt	Registration No. (Attorney/Agent)	41,255
Signature		Date	6/15/00

Burden Hour Statement: This form is estimated to take 0.2 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Box Patent Application, Washington, DC 20231.

Atty Docket No. E0902

PROGRAMMABLE BI-DIRECTIONAL MII TESTING METHODOLOGY AND DEVICE INCLUDING SAME

by

Oikwan Tsang
Yatin R. Acharya

CERTIFICATION UNDER 37 CFR 1.10

I hereby certify that the attached patent application (along with any other paper referred to as being attached or enclosed) is being deposited with the United States Postal Service on this date **June 15, 2000**, in an envelope as "Express Mail Post Office to Addressee" Mailing Label Number **EJ887877334US** addressed to the: Box Patent Application, Assistant Commissioner for Patents, Washington, D.C. 20231.

David Friedman
(Typed or Printed Name of Person Mailing Paper)

(Signature of Person Mailing Paper)

G:\DOCUMENT\JP\AMDS\P379US\EXPRESS COVER.wpd

TITLE: **PROGRAMMABLE BI-DIRECTIONAL MII TESTING METHODOLOGY AND DEVICE INCLUDING SAME**

BACKGROUND OF THE INVENTION

Technical Field of the Invention

The present invention generally relates to methods and structures for testing network interface devices.

Description of the Related Art

Network interfaces for connecting a device, such as a computer, to a network, commonly include a media access controller ("MAC") and a physical layer device ("PHY" or "PHY device"). The MAC insures that data being sent is properly formatted and dressed, so that frames or packets of data are properly recognized by other devices on the network. Signals from the MAC are sent to the PHY which handles the actual transmission of signals on a network medium. The network medium may be any of a variety of well known media, such as fiber-optic cables or various types of dedicated metal-wire cables such as twisted shielded pair, 10 BASE-T, and wiring for telephone lines. Alternatively, the network medium may include wireless communication. During the manufacture of network interface components or devices, such as the PHY and MAC devices described above, the components are tested at various stages of the process. Manufacturers have significant economic inventive to detect and discard faulty components as early in the manufacturing process as possible.

In evaluating the performance of a device it is desirable to be able to independently test the internal blocks of the device. Prior devices have utilized additional dedicated pins to facilitate such testing. However, it will be appreciated that the use of dedicated pins for testing internal components may increase product cost, size, and complexity.

Accordingly, it will be appreciated that it would be desirable to have network interface devices and methods for testing such devices which overcome the aforesaid disadvantages.

SUMMARY OF THE INVENTION

The network interface device has an external interface and multiple blocks of operative components, pairs of the blocks having internal connections between them. The network interface device is configurable to reroute one or more of the internal connections onto the external interface to allow testing of the blocks of the device. The external interface may also be coupled so as to pass data between the network interface device and higher levels in a network protocol stack. In an exemplary embodiment a network interface device has a media access controller (MAC) and a physical layer device (PHY). An internal media independent interface (MII) between the MAC and the PHY may be selectively rerouted to an external MII for independently testing operation of either the MAC or the PHY.

According to an aspect of the invention, a network interface device has multiple blocks with internal connections, one or more of the internal connections being selectively reroutable to an external interface of the network interface device.

According to another aspect of the invention, a method of testing internal blocks of a network interface device includes rerouting one or more internal connections of the network interface device to an external interface of the device.

According to yet another aspect of the invention, a network interface device includes a MAC, a PHY, and a switchable connection between the MAC and the PHY for re-routing all or part of the interface to an external interface of the device.

According to still another aspect of the invention, a network interface device includes an external media independent interface (MII), the MII being usable in normal operation to interface with devices on a higher level in a network protocol stack, and being usable to test operation of individual blocks of the device.

According to a further aspect of the invention, a network medium interface includes first and second blocks, an external interface, and a switchable connection, wherein the switchable connection may be selectively configured either to internally connect the blocks to each other, or to connect one of the blocks to a transmit portion and/or a receive portion of the external interface.

According to a still further aspect of the invention, a method of testing operation of an internal block of a network medium interface includes the steps of reconfiguring the device so that a normally-internally-connected connection of the block are connected to an external interface; inputting test signals to the block; and evaluating output of the block.

To the accomplishment of the foregoing and related ends, the invention comprises the features hereinafter fully described and particularly pointed out in the claims. The following description and the annexed drawings set forth in detail certain illustrative embodiments of the invention. These embodiments are indicative, however, of but a few of the various ways in which the principles of the invention may be employed. Other objects, advantages and novel features of the invention will become apparent from the following detailed description of the invention when considered in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the annexed drawings:

Fig. 1 is a block diagram of a network interface device in accordance with the present invention;

Fig . 2 is a block diagram of a test system for testing a network interface device such as the device of Fig. 1;

Fig. 3 is a block diagram of a specific embodiment network interface device of the present invention; and

Figs. 4-9 are block diagrams of the network interface device of Fig. 3 configured in various test modes, for testing individual of the blocks of the network interface device.

DETAILED DESCRIPTION

As described below, a network medium interface device includes an external interface, such as a media independent interface (MII), which may be used in normal operation for passing data to and from the network medium interface device. The network medium interface device may also be configured in one or more test modes. The test mode configurations enable the external interface to transmit data to and/or receive data from normally-internally-connected blocks of the network medium interface device. The network medium interface device includes one or more switchable connections for allowing internal connection of blocks of the network medium interface device, or for allowing connection of the blocks to the external interface during test mode operation.

Fig. 1 shows a conceptual diagram of a network medium interface device 10 of the present invention. The interface device 10 includes blocks 12, 14, and 16, as well as switchable internal connections 18 and 20. The blocks 12, 14, and 16 may include devices such as physical layer devices (PHYs) and media access controllers (MACs). They also may include state machines, control logic, data registers, FIFOs, and hardware for interfacing within a network stack. Such interfacing hardware may include hardware for interfacing with a network medium such as twisted shielded wire, fiber optic cable, or telephone lines. Such hardware may include an analog front end (AFE) and

magnetics for sending and receiving signals along a network medium. The blocks may also include hardware for making connections to devices at higher layers of a network protocol stack.

The network interface device 10 also includes an external interface 24 which may be used in normal operation to pass data between one or more of the internal blocks 12, 14, and 16 and a higher-level device and/or driver which is coupled to the external interface 24. The network interface device 10 may also be configurable, via configuration of the switchable internal connections 18 and 20, to enter one or more test modes in which one or more of the normally-internal connections between the blocks 12, 14, and 16, are rerouted to the transmit and/or receive portions of the external interface 24. This test mode rerouting allows testing of the operation of one or more of the blocks 12, 14, and 16. The flexibility of the external interface 24, which as indicated above may be used both in normal operation and in test mode operation, allows the network interface device 10 to be produced with fewer pins. This may reduce cost, size, and/or complexity of the network interface device.

Turning now to Fig. 2, a test system 30 is shown for testing the network interface device 10. The network device 10 is operatively coupled to a tester 34 via a test fixture 36, such as a circuit board or test head. The tester 34 may be of a conventional configuration, for example with means for sending and receiving data in order to test various aspects of the operation of the device 10. The test fixture 36 may also be of a conventional configuration, for example with a device-under-test board (DUT board) which receives contacts such as pins of the network device 10, with mechanical and/or pneumatic means for securing the network device to the test fixture, and with means such as spring-loaded probes for electrically connecting the tester 34 to contact points on the DUT board. The contact points are electrically connected to the pins of the device 10. It will be appreciated that a variety of suitable testers and test fixtures are well known in the art.

Fig. 3 shows a block diagram of a specific network interface device 50. The interface device 50 includes a MAC block 52 which is internally coupled to a PHY block 54 via a MAC-PHY switchable connection 56. The MAC block 52 and the PHY block 54 have respective MII interfaces 62 and 64 to facilitate communication between the MAC block and the PHY block. An exemplary MII specification is described in IEEE standard 802.3u-1995, which is incorporated herein by reference in its entirety. The MAC block 52 includes one or more MACs and other items such as state machines, data registers, etc. The PHY block 54 likewise contains one or more PHYs and other items. In addition the PHY block 54 includes a network medium interface including such items as an analog front end (AFE) and items such as magnetics for sending signals along a network medium.

The network interface device 50 has two external interfaces for interfacing with devices and/or software on higher levels of a network protocol stack. The external interfaces are a bus interface 66 and an external MII interface 70. The bus interface 66 may be an interface such as a peripheral component interconnect (PCI) interface for connecting to a bus of a computer, to allow communication between the network interface device 50 and software drivers installed on the computer. The external MII 70 may be used to connect with a legacy device, such as a legacy MAC, which is in turn coupled to software drivers in communication with application software and/or operating system software. Thus the network interface device 50 may be incorporated as part of a network interface card which includes other PHY devices and/or MAC devices, for example allowing communication via other types of network media and/or via other protocol specifications.

Control logic 74 is used to control communication to and from the network interface device 50 via the external interfaces 66 and 70. The control logic 74 may include means, such as data registers, state machines, FIFOs, etc., for routing data to one or both of the external interfaces 66 and 70, for

receiving and manipulating data acquired by the external interfaces, and/or for controlling internal routing of data via an interface switchable connection 76.

The network interface device 50 is configurable to allow testing of the MAC block 52, the PHY block 54, and/or the bus interface 66, via use of the transmit and/or receive pins of the external MII 70. For example, in Fig. 4 the network interface device 50 is configured to test the performance of the MAC block 52 in processing frames, packets, or other data to be transmitted onto a network medium. A transmit (TX) portion 80 of the external MII is operatively coupled to the MAC block 52 via a TX switchable connection 82, the interface switchable connection 76, and the control logic 74. Output from the MAC block 52 is routed to a receive (RX) portion 84 of the external MII 70, via the MAC-PHY switchable connection 56 and an RX switchable connection 86. Thus the network interface device 50 may be coupled to a suitable tester and test fixture, with input signals sent via the TX portion 80 of the external MII 70, processed by the MAC block 52, and output from the MAC block routed back to the tester via the RX portion 84 of the external MII. Thus performance of the MAC block 52 may be verified and/or evaluated.

It will be appreciated that switchable connections such as the connection 56, 76, 82, and 86, are well known in the art. Switching of such connections may be accomplished by sending signals to test registers inside the network interface device 50. Alternatively switching may be accomplished by using external pins to put the network interface device 50 into one or more test modes, for example using an external pin or pins to send a test_mode_select signal, as illustrated in Fig. 3. For example, signals to put the network interface device into a test mode may be sent via the external MII 70.

Turning now to Fig. 5, a test mode is shown wherein performance of the MAC block 52 may be evaluated as to processing of signals received from a network medium which would be attached to the network interface device 50.

Figs. 6 and 7 show test mode configurations for testing the PHY block 54 respectively for receive and transmit operations. In the test mode configuration of Fig. 6, output from the PHY MII 64 of the PHY block 54 is routed through the MAC-PHY switchable connection 56 and the PX switchable connection 86, to the RX portion 84 of the external MII 70. A tester may send a test signal via a test interface to an external network medium interface 90 of the PHY block 54. For example, the test signal may include simulated data in a form that would be passed along a network medium. By examining the output from the RX portion 84 of the external MII 70, performance of the PHY block 54 in receiving data from a network medium may be evaluated.

In Fig. 7 transmit operations of the PHY block 54 may be evaluated. Simulated data is sent from a tester through the TX portion 80 of the external MII 70, through the switchable connections 86 and 56, and into the PHY block 54 via the PHY MII 64. Output from the external network medium interface 90 of the PHY block 54 may be recorded and/or evaluated by the tester.

Figs. 8 and 9 show test modes of the network interface device 50 for testing performance of the bus interface 66. In the test mode of Fig. 8 the bus interface 66 is coupled to the TX portion 80 of the external MII 70, via the switchable connections 82 and 76. Test signals may be input through the TX portion 80 with output from the bus interface 66 received and/or evaluated by a test device. The test mode of Fig. 8 may be used to examine performance of the bus interface 66 during receive operations.

In the test mode of Fig. 9, the bus interface 66 is coupled to the RX portion 84 of the external MII 70, for testing transmit operations through the bus interface. Test signals are input on pins of the bus interface 66, and output from the bus interface is routed through the switchable connections 76 and 86, to the RX portion 84. From the pins of the RX portion 84, the output may be routed to a tester via a test interface. Thus performance of the bus interface 66

may be evaluated for transmit operations (operations where data is to be sent on a network medium).

It will be appreciated that the terms "media independent interface" and "MII", as used herein, are intended to include variations on the standard MII, such variations including the reduced media independent interface (RMII) and the serial media independent interface (SMII). The standard MII has a four-bit wide data stream. The RMII and the SMII have two-bit and one-bit data streams, respectively, but utilize fewer pins than the standard MII.

It will be appreciated that the MAC block 52 may include more than one MAC and the PHY block 54 may include more than one PHY, if desired. For example, multiple MACs and PHYs may be utilized where the network interface device 50 is used to transmit and receive data in multiple formats. In an exemplary embodiment, the network interface device 50 transmits and receives data along standard telephone lines, in both the home phone networking alliance (HPNA) 1.0 and 2.0 specification formats. The network interface device of such an exemplary embodiment may be included as part of a network interface card which also allows connection to other types of network media. It will be appreciated that MAC blocks containing multiple MACs and PHY blocks containing multiple PHYs may include appropriate additional sub-blocks such as multiplexers and suitable control logic.

Although the invention has been shown and described with respect to a certain embodiment or embodiments, it is obvious that equivalent alterations and modifications will occur to others skilled in the art upon the reading and understanding of this specification and the annexed drawings. In particular regard to the various functions performed by the above described elements (components, assemblies, devices, compositions, etc.), the terms (including a reference to a "means") used to describe such elements are intended to correspond, unless otherwise indicated, to any element which performs the specified function of the described element (*i.e.*, that is functionally equivalent),

even though not structurally equivalent to the disclosed structure which performs the function in the herein illustrated exemplary embodiment or embodiments of the invention. In addition, while a particular feature of the invention may have been described above with respect to only one or more of several illustrated embodiments, such feature may be combined with one or more other features of the other embodiments, as may be desired and advantageous for any given or particular application.

What is claimed is:

1. A network medium interface comprising first and second blocks, an external interface, and a switchable connection, wherein the switchable connection may be selectively configured either to internally connect the blocks to each other, or to connect one of the blocks to a transmit portion and/or a receive portion of the external interface.

2. The device of claim 1, wherein the external interface is a media independent interface (MII).

3. The device of claim 2, wherein the MII transmits and receives data in four-bit wide data stream..

4. The device of claim 1, wherein one of the blocks includes a physical layer device (PHY).

5. The device of claim 1, wherein one of the blocks includes a media access controller (MAC).

6. The device of claim 1, wherein the switchable connection is a first switchable connection, and further comprising a third block and a second switchable connection which may selectively configured either to internally connect the third block to the first block, or to connect either the first sub and/or the third sub to the transmit portion and/or the receive portion of the external interface.

7. The device of claim 6, wherein the first block includes a media access controller (MAC).

8. The device of claim 6, wherein the third block includes a bus interface.

9. The device of claim 8, wherein the bus interface is a peripheral component interconnect (PCI) interface.

10. The device of claim 6, wherein the second block includes a physical layer device (PHY).

11. The device of claim 6, wherein the first and second switches may be configured to test operation of the first block by connecting receive and transmit ends of to respective portions of the external interface.

12. A method of testing operation of an internal block of a network medium interface, comprising:

reconfiguring the device so that a normally-internally-connected connection of the block are connected to an external interface;

inputting test signals to the block; and

evaluating output of the block.

13. The method of claim 12, wherein the reconfiguring includes connecting two normally-internally-connected connections of the block to the external interface.

14. The method of claim 12, wherein the reconfiguring includes configuring one or more switchable connections operatively coupled to the block.

15. The method of claim 14, wherein the configuring includes sending signals to the one or more switchable connections.

16. The method of claim 15, wherein the sending signals includes sending the signals through pins of the network medium interface.

17. The method of claim 12, wherein the external interface is a media independent interface (MII).

18. The method of claim 12, wherein the block includes a media access controller (MAC).

19. The method of claim 12, wherein the block includes a physical layer device (PHY).

20. The method of claim 12, wherein the block includes a second external interface.

21. The method of claim 20, wherein the second external interface is a bus connector.

ABSTRACT OF THE INVENTION

The network interface device has multiple blocks having internal connections, and has an external interface. The network interface device is configurable to reroute one or more of the internal connections onto the external interface to allow testing of the blocks of the device. The external interface may also be coupled so as to pass data between the network interface device and higher levels in a network protocol stack. In an exemplary embodiment a network interface device has a media access controller (MAC) and a physical layer device (PHY). An internal media independent interface (MII) between the MAC and the PHY may be selectively rerouted to an external MII for independently testing operation of either the MAC or the PHY.

R:\JP\AMDS\P379US\P0379.APP.wpd

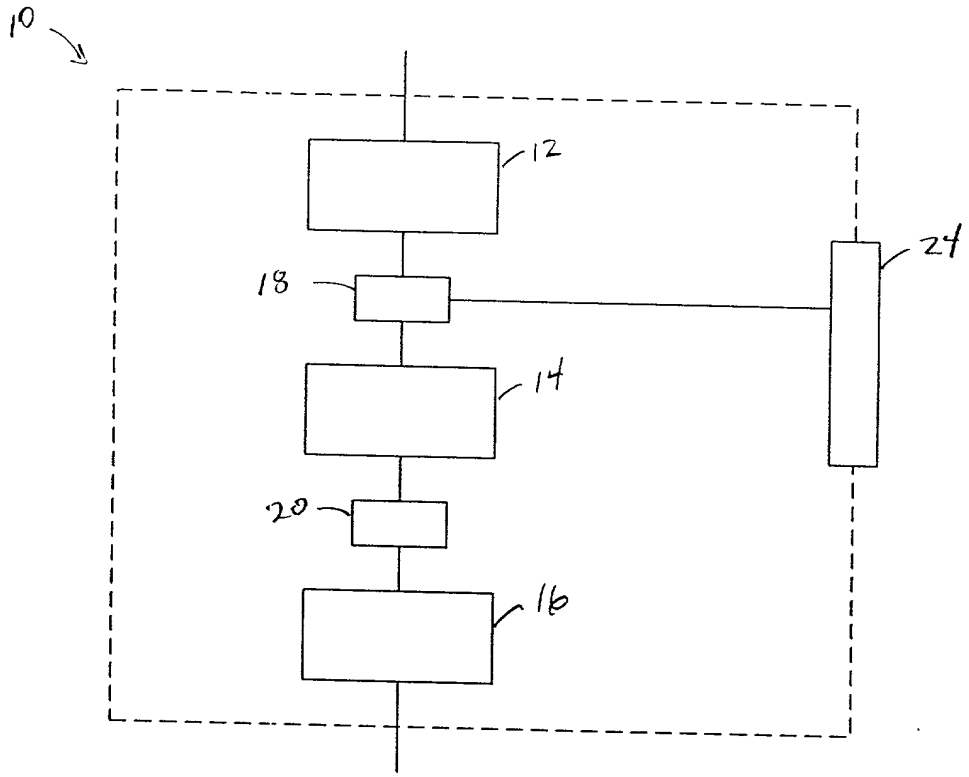


Fig. 1

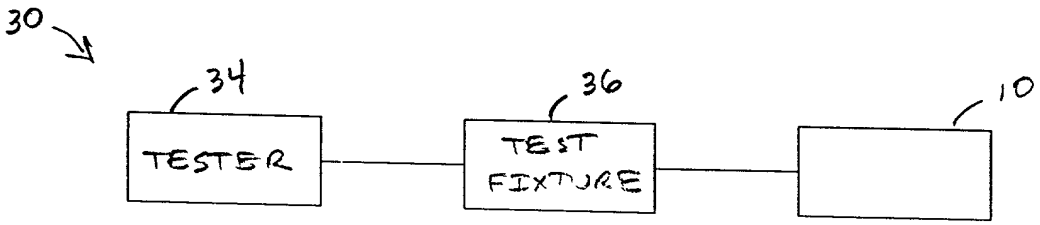


Fig. 2

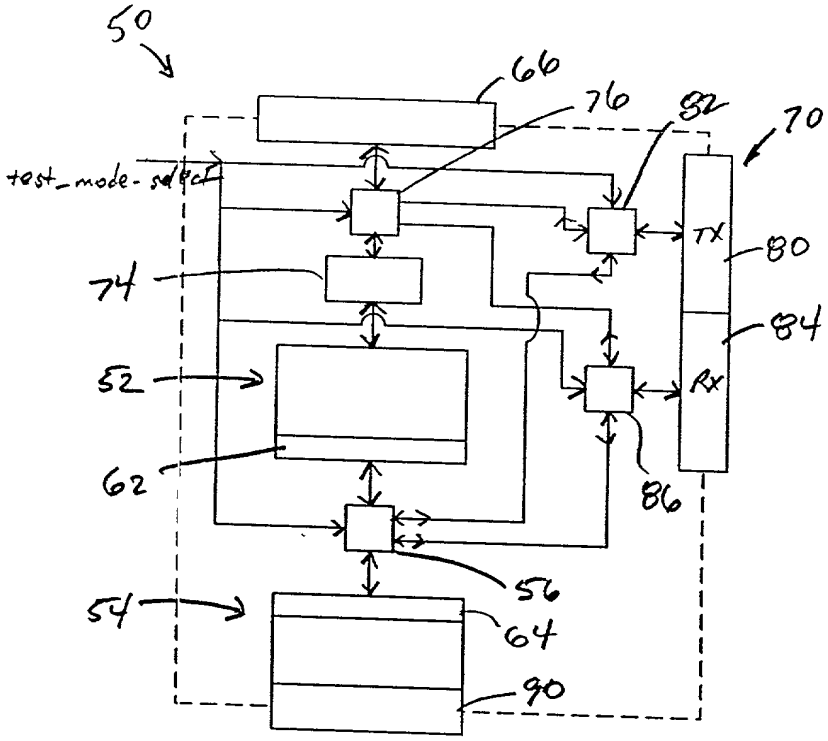


Fig. 3

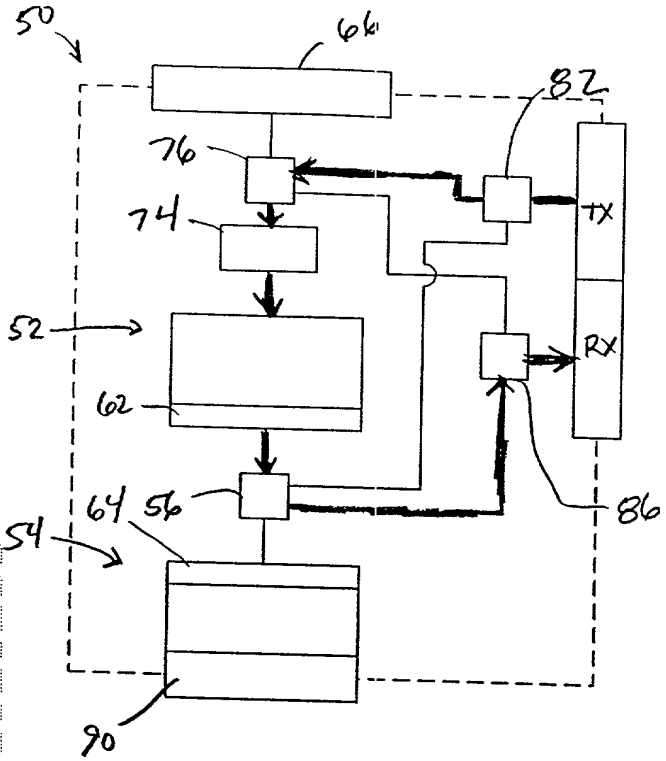

50
66
82
76
74
TX
52
RX
62
64
56
86
54
90

Fig. 4

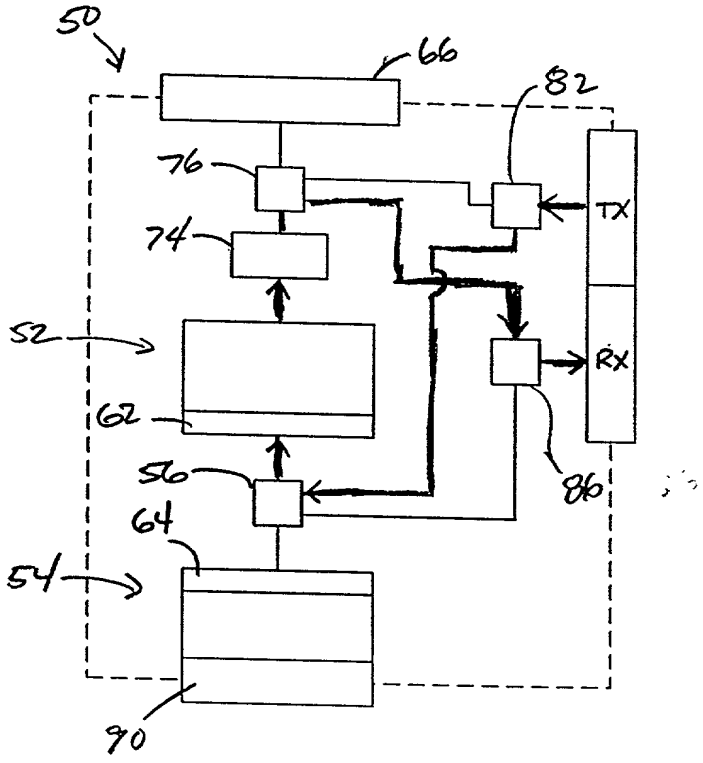

50
66
82
76
74
TX
52
RX
62
56
86
64
54
90

Fig. 5

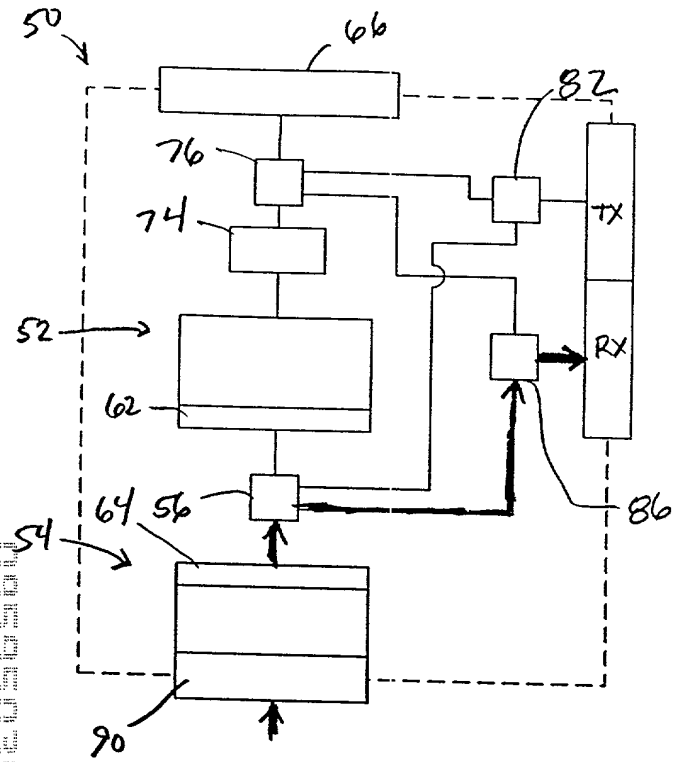

50
66
82
76
74
TX
52
RX
62
64
56
86
54
90

Fig. 6

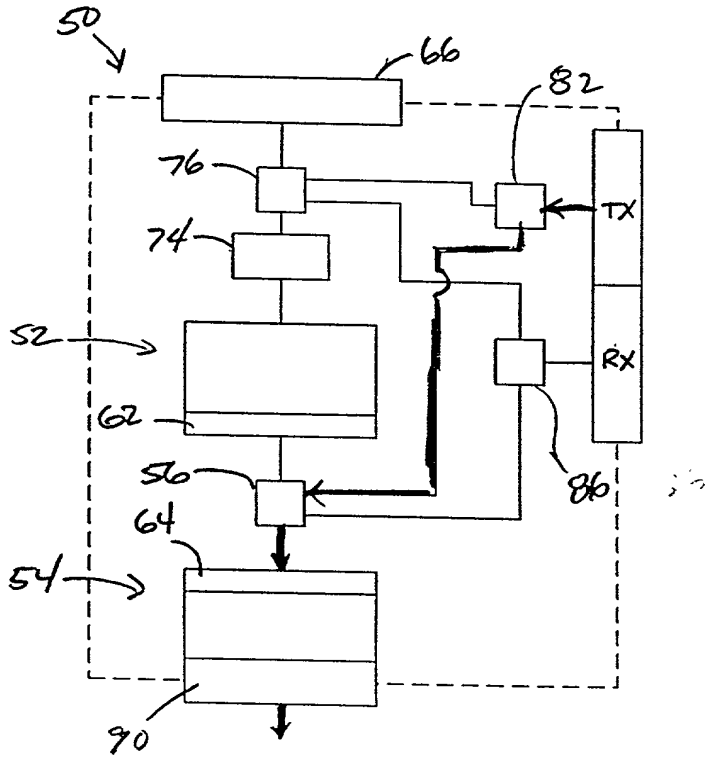

50
66
82
76
74
TX
52
RX
62
56
86
64
54
90

Fig. 7

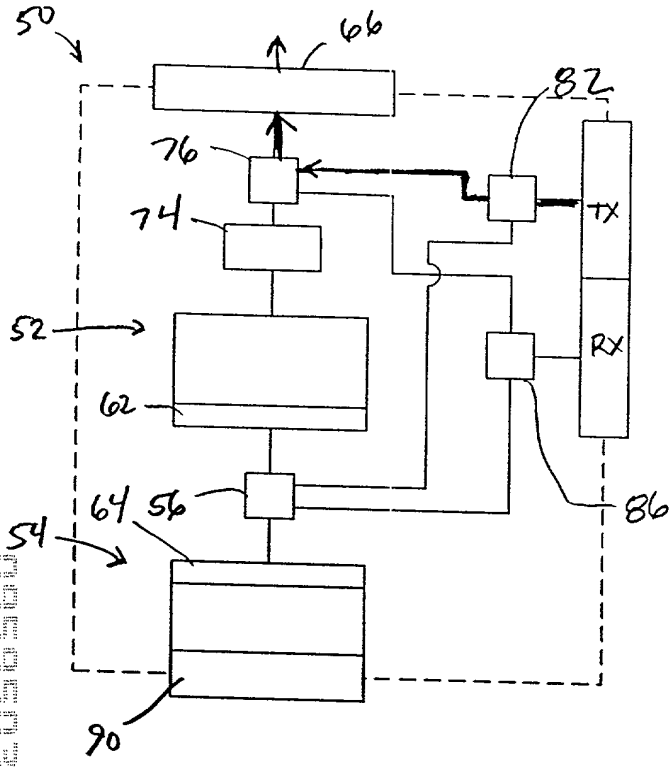

50
66
82
76
74
TX
52
RX
62
64
56
86
54
90

Fig. 8

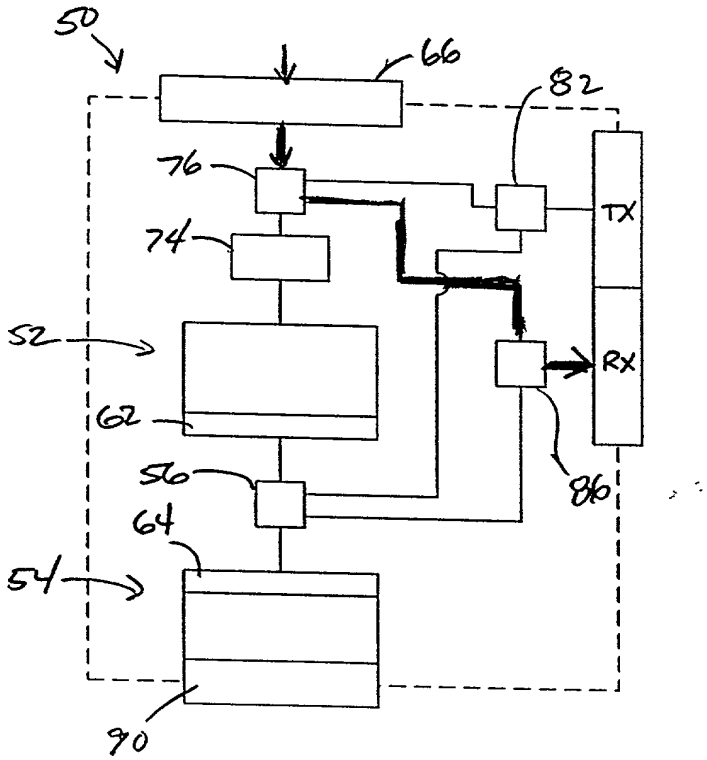

50
66
82
76
TX
74
52
RX
62
56
86
64
54
90

Fig. 9

AMD Docket No. E0902 **PATENT (US)**

COMBINED DECLARATION AND POWER OF ATTORNEY
(ORIGINAL, DESIGN, NATIONAL STAGE OF PCT)

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Title: **PROGRAMMABLE BI-DIRECTIONAL MII TESTING METHODOLOGY AND DEVICE INCLUDING SAME**

the specification of which

[X] is attached hereto, or

[ ] was filed as United States Application or PCT International Application *(give Express Mail label number and deposit date if Application number not yet known)*: Application No.: *(Express Mail Label No.)* Filing Date: *(Deposit Date)* Amended on *(if applicable)*:

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability as defined in Title 37, Code of Federal Regulations § 1.56(a).

CLAIM FOR BENEFIT OF EARLIER U.S./PCT APPLICATION(S) UNDER 35 U.S.C. 120

I hereby claim the benefit under 35 U.S.C. 120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of 35 USC 112, I acknowledge the duty to disclose material information as defined in 37 CFR 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

Application No.	Filing Date	Patent Number

CLAIM FOR BENEFIT OF EARLIER U.S. PROVISIONAL APPLICATION(S) UNDER 35 U.S.C. 119(e)

I hereby claim the benefit under 35 USC 119(e) of any United States provisional application(s) that is/are listed below

Application No.	Filing Date

POWER OF ATTORNEY

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (List name and registration number)

Name	Registration No.	Name	Registration No.
Warren A. Sklar	26,373	Neil A. DuChez	26,725
Mark D. Saralino	34,243	M. David Galin	41,767
Jonathan A. Platt	41,255	Michael J. D'Aurelio	40,977
Vincenzo D. Pitruzzella	28,656	Richard J. Roddy	27,688
William D. Zahrt II	26,070	Paul S. Drake	33,491
Louis A. Riley	39,817	Elizabeth A. Apperley	36,428

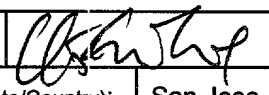
Send Correspondence To:

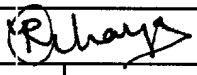
Jonathan A. Platt
Renner, Otto, Boisselle & Sklar, LLP
1621 Euclid Ave. - 19th Floor
Cleveland, Ohio 44115

Direct Telephone Calls To:

Name: Jonathan A. Platt
Tel. No: 216/621-1113
Fax No. 216/621-6165

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued therein.

Full Name of Sole or First Inventor:	Oikwan Tsang		
Inventor's signature:		Date:	6/14/2000
Residence: (City & State/Country):	San Jose, California	Citizenship:	US
Post Office Address:	1108 Little John Way, San Jose, California 95129		

Full Name of Additional Joint Inventor *(if any)*:	Yatin R. Acharya		
Inventor's signature:		Date:	6/14/2000
Residence: (City & State/Country):	Sunnyvale, California	Citizenship:	India
Post Office Address:	1235 Wildwood Avenue, #91, Sunnyvale, California 94089		

CHECK FOR ANY OF THE FOLLOWING ADDED PAGES(S) WHICH FORM A PART OF THIS DECLARATION

___ Signature for third and subsequent joint inventors. Number of pages added ___.
___ Added page to combined declaration and power of attorney for divisional, continuation, or continuation-in-part (CIP) application.
X This declaration ends with this page.

C:\109\Platt-ja\AMDS\p379\AMDS\p379.declaration